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EDUCATING PHYSICIANS

CONTEXT AND CHALLENGES

CONTEMPORARY MEDICAL EDUCATION would be unrecognizable to physicians in nineteenth-century America. Preparation of doctors then was a relatively informal and unfettered affair: admission standards were lax, and in most instances only a high school education was required. The curriculum consisted of sixteen weeks of lectures, repeated for eight months of instruction. There was no patient contact or laboratory experience, and all matriculants graduated with an M.D. degree regardless of academic performance. Teachers were typically practicing physicians who gave instruction part-time as a means of supplementing their income (Ludmerer, 1985, 1999). Medical schools varied in both organization and quality, ranging from elite university programs to small for-profit enterprises. With no accreditation standards, many of these medical schools were of poor quality indeed. With no certification or licensing requirements, many practicing physicians were marginally competent, if at all. It was virtually impossible for members of the public to know if the medical care they received was quality or quackery.

The document that changed medical education and practice was the Flexner Report of 1910. Challenged by highly variable physician performance and the lack of standards in medical education, the American Medical Association's Council on Medical Education, under the leadership of Dr. N. P. Colwell, conducted a survey of medical schools and found many of them wanting. However, as a membership organization the AMA was in an awkward position if wholesale condemnation of medical education was required. Therefore, in 1908 the AMA sought the help of the newly formed Carnegie Foundation for the Advancement of Teaching to conduct a comprehensive study of medical education in North

America. Henry Pritchett, president of the foundation, commissioned not a physician but an educator, Abraham Flexner, to lead the study. The choice of a non-physician was astute; as Flexner later recalled, "Dr. Colwell and I made many trips together, but, whereas he was under the necessity of proceeding cautiously and tactfully, I was fortunately in position to tell the truth with utmost frankness" (Flexner, 1940, p. 115).

By the time Flexner and Colwell visited all 155 medical schools in the United States and Canada in 1909 and issued his report in 1910, the basic framework of contemporary medical education was already taking shape. The transformation that shifted medical education to its current rigorous, science-based form began in the mid-nineteenth century with the rise of experimental medicine in German universities, where research laboratories empirically confirmed or disproved hypotheses about mechanisms of disease. This experimentalist approach challenged the established medical culture, in which both learning and practicing medicine were based on tradition and the works of ancient physicians. American physicians, attracted to Germany and laboratory research, returned from visits abroad imbued with this spirit of scientific medicine and determined to adopt the model for preparing physicians at their universities, which included Chicago, Cornell, Harvard, Michigan, Pennsylvania, and later Johns Hopkins, where the empirical approach to medicine achieved its zenith. Through the efforts of these reformers, medical education was brought into the university and medical laboratories were established along with teaching hospitals (Ludmerer, 1985).

In preparation for his site visits, Flexner visited Johns Hopkins, where his brother Simon had studied medicine before becoming the first director of the Rockefeller Institute for Medical Research. There he spoke to leading physicians who had strong opinions about what a medical school should be, having created one only twenty years earlier. Flexner adopted the Johns Hopkins model as his standard, comparing the schools that he visited to it.

During his site visits, Flexner encountered a number of excellent university-based programs of medical education that met his criteria. Flexner believed that medical practice must be firmly rooted in the foundation of science, not in superstition, speculation, and uncritical empiricism. He saw inculcation of scientific curiosity and methods of investigation as essential to medical education, drawing a parallel between research and practice: "No distinction can be made between research and practice. The investigator, obviously, observes, experiments, and judges; so do the physician and surgeon who practice their art in the modern spirit. At bottom the intellectual attitude and processes of the two are—or should be—identical.... If this position is sound, the ward and the

laboratory are logically, from the standpoints of investigation, treatment, and education, inextricably intertwined" (Flexner, 1925, pp. 4, 6).

The Flexner Report

Because medicine is a science-based practice, Flexner argued, medical schools should be housed in universities, which should also have teaching hospitals, and scientific inquiry should be the modus operandi from the laboratory to the hospital. To ensure that all North American medical education achieved the desired standards, Flexner proposed a number of features of a four-year M.D. degree, which have become common requisites:

- High admissions standards, including requiring a bachelor's degree with a strong science focus, rather than merely a high school degree, as was typical at the time
- A university-based medical school to train students to think like scientists, furnishing two years of basic science instruction instead of a mere eight months of lectures
- Two years of supervised clinical experience by university-based physicians in a teaching hospital
- Experience in investigation through supervised immersion in laboratories and clinical settings
- Instruction by physician-scientists who could move effortlessly from the research laboratory to the bedside and back

In his report, Flexner identified a number of medical schools that did not fit the Johns Hopkins University template, generally small proprietary schools that appalled him, as the acerbic characterizations in his report make clear. He decried their poor quality of instruction, facilities, faculty members, students, administrators, and clinical training. The impact of Flexner's report was amplified by the muckraking journalists of the era, and within a decade approximately one-third of the 155 medical schools closed or merged with other schools. Unfortunately, several of the schools that closed had offered the only access to medical education available to women and African Americans, a situation that was not rectified until the 1970s.

The Medical Profession's Response

Within a decade of publication of the Flexner report, accreditation, certification, and licensing procedures were put into place to protect the public and monitor (and, when necessary, sanction) schools of medicine.

Accreditation processes for schools of medicine were fortified, and the National Board of Medical Examiners (NBME) established the NBME Part Examination program. State medical boards, which had begun to license practicing physicians in the mid-1880s, reorganized their coordinating entity, formerly the National Confederation of State Examining and Licensing Medical Boards into the Federation of State Medical Boards (FSMB), founded in 1912. The current licensing sequence, the United States Medical Licensing Examination (USMLE), was introduced in the early 1990s and replaced the NBME Part Examination and the FSMB's Federation Licensing Examination (FLEX) program. Founded in 1915 in response to the call of the Flexner report to assure the public that all graduates of U.S. medical schools were competent, NBME saw its scope of authority as covering five years: four years of medical school plus one of internship. Likewise, the AMA's Council on Medical Education regarded its role as extending through this fifth year, and in 1919 it published "Essentials for Approved Internships" and a list of "approved" internships. By 1923, there were enough intern positions to accommodate all graduates of U.S. medical schools.

Specialization and Graduate Medical Education

For the first half of the twentieth century, most physicians worked as general practitioners, caring for adults and children, performing surgeries, and delivering babies. Consequently, for most physicians the general internship year was appropriate preparation, and there was no need for a period of training devoted to specialization. However, some graduates of the internship sought more advanced clinical education. At that time, specialty training was seen as preparation for those graduates who planned careers as faculty members and clinical investigators. This advanced training was accomplished mainly through completion of a program in a degree-granting school of graduate medical education or by pursuing further intensive university-based clinical training, called residency. Both routes had a strongly academic character. In 1925, only twenty-nine hospitals in the United States offered residencies, and even up to World War II a small minority of medical school and internship graduates sought residency training (Ludmerer, 1985).

Reminiscent of the variability of undergraduate medical education prior to Flexner, rigorous advanced residency programs coexisted through the 1920s along with inadequate "short courses," as brief as two weeks, after which a physician would declare himself a specialist. Beginning in 1917, but predominantly during the 1930s, specialty boards were founded, with their major goal to define and standardize the

duration and content of advanced training and to administer a specialty examination after which a physician could call himself a specialist. By the end of the 1930s, hospital-based residency programs supplanted the freestanding schools of graduate medical education, but still 75 percent of medical school graduates pursued an internship only and practiced as general practitioners.

After World War II, residency positions increased dramatically, and residency programs, which had been a pyramid shedding trainees who were perceived to be less academically promising along the way, were restructured so that essentially everyone who began a residency could complete the course of training. The advanced clinical training and preparation for a career in clinical investigation that before the war had been the purpose of residency training was shifted to a postresidency phase called *fellowship*. Then, in the early 1950s, graduate medical education underwent systematic expansion. A number of factors underlay this growth. The advent of private, employer-based insurance during World War II increased the demand for care at teaching hospitals and generated enthusiasm on the part of teaching hospitals for resident manpower; the higher prestige of specialty, and ultimately subspecialty, medicine decreased interest among medical school graduates for classical general practice; and even in those relatively early days of modern medicine, the complexity of the field made competent practice over the broad array of primary specialties difficult.

Since 1938, the number of first-year residency positions has consistently exceeded the number of graduates of U.S. medical schools; the difference is made up by graduates of U.S. schools of osteopathy (which were not part of this study) and the graduates of allopathic medical schools outside the United States. Residency positions and the dependence of teaching hospitals on resident participation in patient care have continued to the present.

Postwar Expansion

The period after World War II saw expansion in medical schools, more biomedical research, and growth in residency education. Medical schools expanded in size and number in response to increasing federal support for research, primarily through the National Institutes of Health (NIH). This funding went primarily to research-intensive medical schools and their associated university teaching hospitals. Consequently, smaller community-based medical schools that had no teaching hospitals and community hospitals did not undergo this expansion (Association of American Medical Colleges, 2008).

In the 1960s and 1970s, federal and state governments funded major expansion of medical schools in response to a perceived physician shortage. This was also a time of curricular innovation, with creation of the organ-system curriculum at Case Western Reserve University and the problem-based curriculum at Michigan State University, McMaster University in Ontario, and the University of New Mexico (Papa & Harasym, 1999), approaches that we describe in Chapter Three. Another significant trend emerged in this period: creation of offices of medical education to bring faculty members from schools of education into medical education to help with evaluation, faculty and curriculum development, and, later, educational technology. Offices of medical education are a unique phenomenon in education for the professions; as we describe in Chapter Six, they have helped to guide many curricular reforms.

Medical schools were also reshaped by the rising demand for medical care and expanded federal funding of Medicare and Medicaid, a trend that continues, as we describe in Chapter Five. Prior to 1965, the year in which Medicare was created, medical schools were small organizations with few faculty members; clinical practice revenues accounted for less than 3 percent of total school revenues (Watson, 2003). In contrast, by 2007 clinical revenue had increased to 40 percent of total revenue, and the number of faculty members in clinical departments expanded comparably (Association of American Medical Colleges, 2008). Medicare and Medicaid funding has not only moved the country toward a one-class system of care but has also transformed teaching hospitals from providers of charity care to providers of care to the poor, covered by Medicare or Medicaid. This change in the financing of clinical service set in motion a gradual shift in medical schools toward more direct patient-care, a larger number of clinical faculty, and dependence on clinically generated revenue. This growth in the clinical enterprise offered expanded learning opportunities for students and residents because of the greater number of patients seen and the emerging medicines and technologies available (Ludmerer, 1999).

This expansionary era led to soaring health care expenditures in the 1970s, which in turn ushered in an era of cost containment and a variety of regulations designed to limit expenditures by Medicare and Medicaid. This placed great pressures on teaching hospitals in the 1980s to reduce costs, increase efficiency, and become more price-competitive, thus challenging their ability to offer a quality learning environment for medical students and residents. As a result, university teaching hospitals became an increasingly difficult place within which to learn because of shortened lengths of stay, growing acuity of patient problems seen

in inpatient settings, and expanding use of complex technological and therapeutic modalities in patient care.

Quality Improvement in Patient Care

By the 1990s and the first decade of the twenty-first century, it became evident that these external pressures on medical schools and teaching hospitals had led to deterioration of the conditions under which clinical education takes place, sparking concern about patient safety, resident duty hours, and minimum competencies of medical graduates. Several Institute of Medicine studies called for greater attention to the quality of patient care and reduction of errors, stimulating improvement efforts across the continuum of medical education and in hospitals nationally (Committee on Quality of Health Care in America, 2000, 2001; Committee on the Health Professions Education Summit, 2003; Association of American Medical Colleges, 2004). Simultaneously, the long duty hours of residents and the lack of sleep associated with working up to 120 hours a week were connected to patient safety concerns and resident well-being. Under threat of congressional legislation, the Accreditation Council for Graduate Medical Education (ACGME) imposed rules on resident duty hours, resulting in a cap of eighty hours a week. Many residency program directors and clinical faculty resisted this constraint because they were concerned that residents would not have enough experience to competently perform difficult procedures, care for a variety of patients, and assume professional responsibility for their patients. Many hospitals resisted because they were dependent on cheap labor from residents and changes would raise their fixed costs. However, all have accommodated this new rule and are working to mitigate its potential adverse effects on education.

Quality improvement in patient care has now become a major movement in American medicine. It is incorporated into the ACGME competencies for all residents. Two of the six competencies relate to quality improvement: practice-based learning and improvement (learning from one's own patients and improving their care), and systems-based practice (working within and improving health care systems of practice). The other competencies are medical knowledge, clinical reasoning, patient communication, and professionalism. Medical schools have elected to use similar competencies for undergraduate medical education as well. Competencies identify general, nondomain-specific areas of performance expected of all trainees at every level of development and have stimulated curricular innovations in graduate medical education and undergraduate medical education (Irby & Wilkerson, 2003).

Increased Specialization

During the 1990s and early twenty-first century, funding for biomedical research from NIH doubled. The result of this expansion was a more intense focus on molecular medicine and breakthroughs in diagnostic and therapeutic modalities. As more knowledge and technology developed, physicians began to narrow their areas of focus, resulting in subspecialization and sub-subspecialization. Prior to 1970, there were nineteen specialties and ten subspecialties approved by the American Board of Medical Specialties (ABMS). Today, ABMS recognizes 24 specialties and 121 subspecialty members (http://www.abms.org/About_ABMS/ABMS_History/).

With ever-increasing specialization, new clinical roles and relationships unimagined by Flexner have arisen. Physicians care for patients in partnership with a variety of other health professionals, such as nurse anesthetists, physician assistants, and clinical pharmacists. As specialization proliferates, companion phenomena have emerged: interdisciplinary patient care teams and research. Although frequently identified with outpatient primary care, generalist physicians who can identify key clinical priorities and integrate input from specialists play a greater role in the hospital as well. Known as hospitalists, these physicians work exclusively in the hospital, caring for patients and coordinating care between a variety of hospital specialists.

The Business of Medical Education

Regardless of specialty or subspecialty, physicians are educated and practice within systems of health care. At the macro level, health care in the United States is a $2.1 trillion business annually and consumes about 16 percent of the gross domestic product. This industry is uncoordinated, and in spite of spending approximately twice as much on health care as do other developed nations, the United States achieves health outcomes unsatisfactory by many standards (Ginsburg et al., 2008). Even among those patients with private or public health insurance, outcomes are substandard due to defects in the delivery system. Moreover, 47 million Americans remain uninsured. In this environment, university teaching hospitals carry a disproportionate share of care for the uninsured while also constituting a learning environment for the next generation of physicians and conducting clinical research. The multiple missions of patient care, care for the poor, teaching, and research—all vying for limited resources—have placed many teaching hospitals at a competitive disadvantage in the health care marketplace. In this context, medical students

and residents learn within systems that are often suboptimal for delivering quality care.

On the broader cultural level, the rise of consumerism and expectations for accountability and transparency are powerfully influencing how medicine is practiced and taught. Information on the performance of hospitals, clinics, and individual physicians is now being collected and made available to the public. Benchmarks of performance are being formulated and results published even though such measures are not always valid indicators.

Finally, a wave of expansion is currently taking place in response to a projected physician shortage for the United States. New medical schools are being established, and existing medical schools are increasing enrollment. However, this is unlikely to meet future demand because of inadequate numbers and quite uneven distribution, in terms of geography and specialties, of physicians. Rural and inner-city communities are unable to attract physicians to practice there, and too many students are choosing procedural specialties rather than primary care. These problems will inhibit appropriate deployment of physicians to areas of need.

The Current Model of Medical Education

Today, there are 130 accredited M.D.-granting medical schools in the United States. The purpose of the four years of undergraduate medical education is to accomplish the general professional education of the physician and to ready physicians-in-training for supervised practice during residency training.

Premedical Education and Admission

Preparation for medical education begins with a bachelor's degree and a common set of science courses. These standard courses are a Flexnerian legacy and include one year of biology, two years of general and organic chemistry, one year of physics, and in some schools one year of mathematics. This grounding in the sciences has long been viewed as important to success in medical school because of the intensity of science instruction in the first two years of the curriculum. However, there is much debate about what coursework should be required for entry into medical school (Dienstag, 2008). Recent work by the AAMC and the Howard Hughes Medical Institute recommends changes in the scientific competencies for premedical and medical school students, an expanded set of prerequisites that more accurately reflect the integrated nature of the basic, clinical, and social sciences and more broadly represents the core competencies

expected of a physician (Association of American Medical Colleges & Howard Hughes Medical Institute, 2009).

In 2007, the total number of applicants to U.S. medical schools offering an M.D. degree rose to some forty-two thousand for eighteen thousand total positions (Association of American Medical Colleges, 2008). Admission decisions are made in large part on the basis of the student's grade point average in science courses and performance on the Medical College Admission Test (MCAT). This exam is oriented toward scientific knowledge and reasoning, expected outcomes of a premedical course of study. Although these criteria predict performance on examinations in the first two years, they do not correlate highly with performance in clerkships or later licensing examinations (Kreiter, Yin, Solow, & Brennan, 2004). In an effort to assess the personal qualities of applicants essential to the practice of medicine, such as compassion, trustworthiness, and dependability, medical school admissions committee and residency selection committee members interview applicants. These interviews are time-intensive and notoriously unreliable (Kreiter et al., 2004). Alternative interviewing practices are beginning to emerge that more accurately assess noncognitive factors in the selection process (Eva, Reiter, Rosenfeld, & Norman, 2004a, 2004b; Eva, Rosenfeld, Reiter, & Norman, 2004).

Those who are selected for the study of medicine discover that their classmates are accomplished and diverse. This diversity was not a feature of medical education in Flexner's day, especially after several schools that educated women and African Americans closed in the wake of his report. Even until the early 1960s, virtually all physicians in training were white men. Diversity in medical education is now enhancing the quality of education for all learners and translating into more effective and culturally competent physicians who are better prepared to serve an increasingly heterogeneous patient population. In addition, minority physicians are more likely to practice in underserved areas and be proficient in languages other than English, thus helping address linguistic and cultural barriers that may hinder provision of quality care (Coleman, Palmer, & Winnick, 2008).

Undergraduate Medical Education

Once admitted to the study of medicine, students begin the two years of classroom-based coursework that is designed to constitute the foundation of formal knowledge on which clinical practice is based. The majority of medical schools offer this in integrated courses organized in discrete time blocks around organ systems or topics (cardiovascular,

renal, respiratory, genetics, cancer). This foundational coursework is followed by two years of clinical practica, organized into specialty blocks called clerkships. During the third year, students rotate through a series of clerkships, typically for four to eight weeks, in the core specialties of family medicine, internal medicine, neurology, obstetrics and gynecology, pediatrics, psychiatry, and surgery. Following these required clerkships and subinternships (advanced clerkships), the fourth year is primarily elective.

Within this broad framework of undergraduate medical education (often referred to as UME, which we describe in depth in Chapter Three), some schools have created unique learning experiences to align with their school's mission; some schools focus on primary care in rural communities, others address public health issues, and others prepare future researchers and academics. Some medical schools offer specialized tracks within their curricula, allowing students to pursue areas of interest such as biotechnology, clinical and translational research, molecular medicine, and global health; such focused programs affording opportunities for students to tailor learning experiences to their interests are responsive to the need for individualization.

Graduate Medical Education

In their fourth year of medical school, students interview at multiple residency programs around the country in their chosen specialty. Residency, or graduate medical education (usually referred to as GME, the subject of Chapter Four), programs largely consist of extensive and intensive clinical experience organized to promote progressive development of knowledge and skills within the resident's chosen specialty; each specialty also requires some didactic education. Residency training spans three to seven years, depending on the specialty. For example, residency programs in internal medicine, family medicine, and pediatrics are three years. Surgical specialties and radiology are at least five years.

Like medical schools, residency programs may have specific goals, such as training individuals to meet the health care needs of a particular region, preparing academic leaders, or setting a clinical foundation for a research career. At completion of residency education, graduates are ready for unsupervised practice within their specialty or may elect to take a fellowship within a subspecialty. Virtually all of the larger clinical specialties have subspecialties; preparation for certification in subspecialties requires another one to three years of training. The great majority of internal medicine residents go on to subspecialize in areas such as cardiology, gastroenterology, geriatrics, and hematology/oncology. Fellowships

follow the structure developed after World War II: typically a year of clinical experience and a year or two of research.

Currently, residency training programs in primary care specialties—particularly family medicine and internal medicine—are having great difficulty in filling the available positions they offer because students are choosing procedural specialties. This is driven by many factors, including inequities in pay among medical specialties, increasing student debt (in 2008 average student debt was $140,000 from medical school alone), and a desire on the part of students to achieve work-life balance and controllable work hours while still earning enough to retire their debt. As a result, fewer and fewer students are choosing primary care specialties, and residency programs in these areas are having difficulty filling their positions with U.S. medical graduates.

In 2008, there were 107,851 residents in 8,490 ACGME-accredited programs training in the United States (Accreditation Council for Graduate Medical Education, 2009). The majority of residency programs are in community-based teaching hospitals, although, because they are larger, university-based residencies train the majority of residents in the U.S. (This is in contrast to Canada, where university medical schools oversee all GME.) The demographics of residents differ from those of medical students because there are 1.3 times as many first-year residency positions as graduates from U.S. medical schools. As an illustration, in 2003, there were some twenty-four thousand first-year residency positions available, yet only fifteen thousand U.S. medical school graduates. The difference is made up by graduates of U.S. schools of osteopathy (6 percent of residents) and international medical graduates (27 percent of residents). International medical graduates practicing in the United States typically attended medical school in India (20.3 percent), the Philippines (10.7 percent), Mexico (6.2 percent), Pakistan (4.5 percent), China (3.3 percent), and the Republic of Korea (2.7 percent) (Hart et al., 2007). A growing percentage of international medical graduates are U.S. citizens trained abroad, predominantly in for-profit schools in the Caribbean. Many residency programs in rural and less desirable inner-city communities have less success in attracting U.S. medical graduates and are therefore especially dependent on international medical graduates.

Given rapid changes in the practice of medicine, physicians must find ways to continuously update their knowledge and learn new skills and procedures. Continuing medical education (CME) programs supply those ongoing educational opportunities, and participation in such programs is a condition for maintaining licensure in many states and continued certification in many specialties. CME is beyond the scope

of this book but has a considerable research literature (Davis, 2005; Davis et al., 1999).

Medical Education's Key Challenges

There is no question that the reforms of undergraduate medical education promoted by Flexner, the development of a phased program of graduate medical education from internship through fellowship, the investments made in biomedical science through the NIH, and the public funding of care for the elderly, disabled, and indigent have in the aggregate produced a remarkable system of health care and, along with it, an exceptional educational program for preparation of physicians. However, the shortcomings of the health care system in the United States in the first decade of the twenty-first century are pervasive and severe (McGlynn et al., 2003). Embedded as it is in the health care system, medical education also has severe shortcomings that require immediate and vigorous corrective action.

In the course of our fieldwork, we saw many instances of foundational knowledge poorly linked to experience; well-thought-out, integrated teaching subverted by inappropriate assessments; and missed opportunities for allowing learners to participate in the important nonclinical roles physicians play within health care and more broadly in society. We also saw exciting innovations through which students and residents were given authority to improve the settings in which they learn and to improve outcomes for patients; and we observed inspiring examples of institutional culture supporting and advancing the humanism and professional values of learners.

In our review and observation of medical education, we were as well influenced by research in the learning sciences and medical education. Much of this research has been distilled in *How People Learn: Brain, Mind, Experience, and School* (Bransford, Brown, & Cocking, 1999) for the National Academy of Sciences. In medical education, research on physician knowledge, reasoning and action, and investigations into workplace learning have contributed to our arguments for change. We review this research in our discussion of practice in Chapter Two, and throughout the book we use it as a lens for our critique of current practices in medical education and make recommendations for future directions.

As we explain in the Introduction, our fieldwork and review of the learning sciences led us to identify four goals for medical education: (1) standardization and individualization, (2) integration, (3) insistence on excellence, and (4) formation of professional identity. Although these

Table 1.1. Flexner's Recommendations for Educating Physicians in 1910

Goals	Challenges	Recommendations
Standardization	Lack of standard, rigorous educational program Poorly prepared students Heterogeneity in student achievement	Insist on a four-year college degree as a prerequisite to medical studies. Standardize a four-year curriculum in 2+2 design. Establish accreditation process for medical schools.
Integration	Limited science in the curriculum No connection between practice and science	Integrate advances in the laboratory with practice at the bedside. Provide clinical training in university teaching hospitals.
Habits of inquiry and improvement	Excessive emphasis on rote memorization rather than on learning by doing in the laboratory and hospital Faculty tradition-bound rather than scientifically oriented	Train physicians to "think like scientists." Require medical education to be taught by scientifically trained faculty members within university settings.
Professional formation	Teaching by unqualified faculty members Role modeling by physicians with varying competency, in many proprietary and for-profit schools	Immerse medical education in university culture. Facilitate close and sustained contact between learners and scientifically based faculty role models.

four goals are consistent with and can be understood as an extension of Flexner's work, they are also the basis for a new agenda for change. Accordingly, we base our descriptive analyses of the various facets of medical education on them.

Table 1.1 describes the goals in terms of the major challenges Flexner found in 1910 and his recommendations for addressing them. Table 1.2 presents them in the context of our findings, along with a summary of our recommendations for the future of medical education, which we present in detail in Chapters Seven and Eight.

Table 1.2. Recommendations for Educating Physicians, 2010

Goals	Challenges	Recommendations
Standardization and individualization	Medical education is: ❍ Not outcomes-based ❍ Inflexible ❍ Excessively long ❍ Not learner-centered	Standardize learning outcomes through assessment of competencies. Individualize learning process within and across levels. Offer elective programs to support development of skills for inquiry and improvement.
Integration	Poor connections between formal knowledge and experiential learning Fragmented understanding of patient experience Poor understanding of nonclinical and civic roles of physicians Inadequate attention to the skills required for effective team-delivered care in a complex health care system	Connect formal knowledge to clinical experience, including early clinical immersion and adequate opportunities for more advanced learners to reflect and study. Integrate basic, clinical, and social sciences. Engage learners at all levels with a more comprehensive perspective on patients' experience of illness and care, including more longitudinal connections with patients. Provide opportunities for learners to experience the broader professional roles of physicians, including educator, advocate, investigator. Incorporate interprofessional education and teamwork into the curriculum.
Habits of inquiry and improvement	Focused on mastering today's skills and knowledge without also promoting knowledge building and an enduring commitment to excellence	Prepare learners to attain both routine and adaptive forms of expertise. Engage learners in challenging problems, and allow them to participate authentically in inquiry, innovation, and improvement of care.

(*Continued*)

Table 1.2. (*Continued*)

Goals	Challenges	Recommendations
Habits of inquiry and improvement (cont'd.)	Limited and often pro forma engagement in scientific inquiry and improvement exercises Inadequate attention to patient populations, health promotion, and practice-based learning and improvement Insufficient opportunity to participate in management and improvement of the health care systems within which they learn and work	Engage learners in initiatives focused on population health, quality improvement, and patient safety. Locate clinical education in settings where quality patient care is delivered, not just in university teaching hospitals.
Professional formation	Lack of clarity and focus on professional values Failure to assess, acknowledge, and advance professional behaviors Inadequate expectations for progressively higher levels of professional commitment Erosion of professional values because of pace and commercial nature of health care	Promote formal ethics instruction, storytelling, and symbols (honor codes, pledges, and white-coat ceremonies). Address the underlying messages expressed in the hidden curriculum, and strive to align the espoused and enacted values of the clinical environment. Offer feedback, opportunities for reflection, and assessment of professionalism in the context of longitudinal mentoring and advising. Promote relationships with faculty who simultaneously support learners and hold them to high standards. Create collaborative learning environments committed to excellence and continuous improvement.

Standardization and Individualization

To promote high academic standards, Flexner argued for standardization based on structural requirements: a bachelor's degree with a rigorous science background for admissions, two years of university-based basic science courses, and two years of clinical experience in a university teaching hospital. Another approach to standardization has been to focus on learning outcomes and the general competencies of the graduates. Two major issues have arisen around the competency movement: how to define and assess complex competencies, and how to promote excellence when competencies are targeted at "good enough" or minimal standards of performance.

Although Flexner's uniformity of structure raised academic standards, a companion problem has emerged: lack of sufficient flexibility in the length of training. In Flexner's day and through the 1940s, most physicians were prepared for practice within five years of graduation from college. Thus physicians began their career at age twenty-six or twenty-seven. Currently, the minimum preparation for independent practice requires seven years after college, and physicians in a long residency and those preparing for an academic career may be in their midthirties before they complete their formal education. Clearly the field of medicine is enormously more complex than it was in Flexner's time, but other factors have contributed to the ever-lengthening process of medical education. Undergraduate medical education has been managed using time-and-process metrics: four years and sometimes longer if a student chooses to extend the period of study to do research, pursues cocurricular or personal interest, or requires remediation. In general, students are not able to "test out" of a significant amount of introductory work, regardless of their undergraduate major and premedical experience. There has been little sustained exploration of approaches that might increase the efficiency of medical education. With the exception of short tracking in internal medicine, where residents in good standing may skip the third year of medicine residency program and go directly into fellowship training, there has been minimal experimentation in allowing medical learners to more rapidly proceed through various levels of education.

Likewise, residency programs have been designed to maximize the likelihood that all, or close to all, residents who proceed through the specified number of months, and across the specified clinical activities and settings, will emerge competent to practice without supervision. By adopting this approach, it is inevitable that some residents will have achieved this level of global competence before the end of the stipulated period and could be advanced more rapidly. According to one study, residents undergoing

a rigorous competency-based training program could become competent in about one-third less time than is currently required in a time-based rotation system (Long, 2000). When we talk about individualization in this regard, we mean the ability of educational programs to adjust to meet students' and residents' learning needs and offer educational experiences that acknowledge differences in background, preparation, and rate of mastering concepts and skills, in contrast to the current one-size-fits-all approach.

Another argument for increasing the efficiency and decreasing the duration of medical training is that the vast majority of students preparing to become physicians acquire extraordinary indebtedness; this debt burden is creating a serious barrier to entry into the profession and is skewing the specialty choice of those who do elect to become physicians. The average medical student debt at graduation has risen, increasing from $80,000 in 1998 to $140,000 in 2007; this does not include premedical school debt (Association of American Medical Colleges, 2008). A well-educated physician workforce is a clear societal need and an important social good (Starfield, 1992). Thus society must take a compelling interest in ensuring that the composition of the physician workforce is appropriate to meet the needs of the public. Career choice is complicated and multifaceted; however, addressing medical student debt is critical to ensuring a socioeconomically diverse group of graduates who choose broadly among medical specialties and subspecialties.

Integration

The formal knowledge foundational to medical practice is not well integrated with acquisition of experiential knowledge over the continuum of medical education. The premedical requirements overemphasize some scientific fields, such as physics, to the detriment of the social sciences and nonscience domains. Early in medical school, even in schools that have fairly extensive clinical exposure, students rarely have clearly defined and authentic clinical roles, and their classroom formal learning is poorly linked, if at all, to what they have experienced in clinical settings. This lack of integration results in early-stage medical students typically failing to appreciate the relevance and clinical context for the information they encounter in their classroom work. The other side of this issue is that, once in a clinical environment, students struggle to recognize the relationships between what they have been taught in the classroom and the problems patients present, and so they feel they have to learn everything all over again. Learning facts disassociated from patients results in a 30–50 percent loss in knowledge by the time students reach the clinical setting

and requires students to reorganize their knowledge in memory from a basic science disciplinary perspective to a patient-centered clinical perspective (Custers, 2008). In addition, students must learn to connect and integrate multiple forms of reasoning (critical and creative thinking, and pattern recognition) and types of knowledge (formal knowledge and case knowledge) in order to care for patients.

The balance between and integration of formal knowledge and experiential learning continues to be challenging in the residency phase of education, although the tables turn. In GME, clinical experience is ascendant; residents often suffer from inadequate time and encouragement to reflect on what they have seen in the course of patient care, to read, to discuss, and to wonder. The shortened length of patients' hospital stays, increased clinical acuity of hospitalized patients, and discontinuity in relationships among faculty, residents, students, hospital staff, and patients have conspired to increase the pace and complexity of the resident's day to the point that it often becomes inimical to learning. The lack of longitudinal relationships creates an inefficient and haphazard system for learners and clinical teachers and less-than-optimal care for patients. Thoughtful attention must be given to both the tempo of the clinical learning environment and the appropriate balance between formal and experiential learning over the entire continuum of medical education.

A second distinct aspect of integration entails an understanding and appreciation of the multiple roles physicians play beyond provision of one-on-one clinical care. Medical school matriculants have often had experience in international health, advocacy, and research. Others are deeply engaged in the humanities and want to explore the connection between their work as a clinician and their experience as a poet or musician. Furthermore, physicians play a key role in the leadership of health care systems, from small practices to hospitals, to managed care organizations, and to insurance companies. We believe medical students and residents should be exposed to these broader roles that physicians play in health care and in society, and they should have the opportunity to explore in a sustained way the integration of the clinical role with these other roles. Currently, these other roles are underemphasized in most schools and residency programs, compromising learners' appreciation and experience of the full dimension of being a physician.

Inquiry and Improvement

Medical education overemphasizes factual medical knowledge and underemphasizes the importance of both clinically driven curiosity and the complex system in which physicians must function. We see curiosity as

the engine of lifelong learning; all physicians, no matter how well educated at completion of residency, must relentlessly question the validity of what they think they know, accept received truths with skepticism, and wonder with every patient what improved understanding or novel therapy is just around the corner. An educational program that continuously prepares its graduates to think in these ways will foster not rote learning, mnemonics, and a tyranny of facts and associations but curiosity, exploration, skepticism, and wonder. Instead of simply presenting scientific concepts as facts, medical education should entail some exploration of the frontiers of science and should examine the controversies within the field. By mastering the tools of scholarship in one area of investigation (for example, molecular medicine, clinical and translational research, medical education, global health sciences, health disparities), physicians-in-training can develop the skills and the habits of mind that will allow them to advance their practice over a lifetime of engagement with the problems and challenges of clinical work.

Medicine is practiced within a complex health care system with many imperfections. Medical education should prepare physicians to address, analyze, and improve the systems within which they work. In some cases, these advances will flow out of large research projects or state- or national-level policy work, but physicians also need to see the daily adaptations they make in practice to better meet the needs of their patients as important ways to advance the field of medicine (Mylopoulos & Scardamalia, 2008).These frequently small practice-based improvements require originality, commitment, effort, and skill and are important steps in improving patient care.

Professional Formation

Curriculum, and often teaching and assessment practices, tends to neglect the fundamentally moral nature of medical practice and consequently of medical education. Even though considerable progress has been made over the past thirty years in including ethics courses in medical school and residency curricula, and in detecting and attempting to remediate lapses in ethical comportment, medical education is still squeamish about addressing the aspirational dimension of medicine, specifically the critical importance of inculcating a desire to be more compassionate, more altruistic, and more humane. This commitment to excellence is a dimension of the moral identity of the physician as well.

Students typically enter medical school with only a superficial understanding of the values underpinning the medical profession and how these values inform every step of the educational process. Whereas students

are expected to learn these values through direct instruction, modeling, and socialization, their practical application is not obvious. For example, how do professional values apply to conflict among team members about patient issues or disruptive behavior of faculty members in the operating room? Or what should a male student do if he is asked by his resident to practice a pelvic exam on an anesthetized woman who has declined male examiners? Typically, the clinical setting is where students observe positive and often negative interactions of physicians with patients and with other health professionals.

Unfortunately, moral development of physicians-to-be is often described as arrested or regressing during medical school and residency training (Branch, 2000; Branch, Pels, Lawrence, & Arky, 1993). Students report having great difficulty accommodating to and being assimilated into the hospital culture (Branch, Hafler, & Pels, 1998). Students often feel trapped between their moral ideals and the desire to conform to the norms, values, and actions of their team. Without a forum to share and reflect on their moral choices, students feel isolated and unable to resolve their identity and ethical conflict. This can lead to depression, loss of empathy, and moral regression (Branch, 2000).

By the time medical learners reach residency, they have been immersed in clinical environments for two or more years and much acculturation has already occurred. However, residency remains the forge that molds and tempers the physician-to-be. Three elements of resident work account for the importance of this phase of medical education: teaching, team leadership and teamwork, and the nature of the resident's role in patient care.

The fact that residents are expected to teach signals the shift in their position in the learning community; although not yet ready for independent patient care, the resident has enough formal knowledge and experience that she is expected to monitor and support the learning of more junior trainees. As we discuss in Chapter Four, residency is also the time when every medical learner is called on to deploy the leadership and management skills demanded by the team leader role. Although the attending physician is responsible for the clinical decisions made by the team under her supervision, the quality of the team interactions and the nature of the work and learning environment are largely determined by the resident. The interactions that a resident has in the team leader role, with subordinates, peers, and superiors, can be positive or equally negative; in either case, they are powerfully formative. Finally, the resident's role in patient care is different from that of the students, and in most programs from interns as well; residents frequently make clinical decisions that are not double-checked in real time. When a fourth-year student detects an unexpected physical finding, his exam will be repeated

and the finding confirmed or refuted within minutes or a few hours. Likewise, when an intern admits a patient, develops a management plan, and writes admission orders, her admit note and orders will be reviewed, and amended and corrected if needed, by the resident who is in the hospital and working in parallel with the intern. In contrast, although the attending physician will see each patient every day, there may be an interval of hours between the resident's assessment of and response to a clinical development and the attending physician's verification. Supervision is always a phone call away, but the resident must recognize when she needs assistance. The sense that the patient's well-being hangs in the balance and that the resident's judgment counts powerfully molds the character of the young physician.

Of course, there are negative influences that threaten to countervail the positive effects of teaching responsibilities, assuming leadership for a team, and being responsible for knowing when help is needed in the absence of real-time supervision. Failure in any of these key domains can shake the resident's confidence. Moreover, residents, like students, receive mixed messages about the core values of the medical profession and see many examples of behavior that should not be emulated. The importance of making formation of an appropriate professional identity a major curricular goal is underscored by recent research showing that lapses in professionalism demonstrated by students during medical school and as residents in training are associated with professional sanctions later in practice (Papadakis, Arnold, Blank, Holmboe, & Lipner, 2008; Papadakis, Loeser, & Healy, 2001; Papadakis, Hodgson, Teherani, & Kohatsu, 2004; Papadakis, Osborn, Cooke, & Healy, 1999; Papadakis et al., 2005). A major, and too-often-neglected, challenge of medical educators is finding the best ways to promote professionalism in medical school and residency training (Stern & Papadakis, 2006).

One of the major ways of promoting professional formation is to immerse trainees in a setting that embodies the highest values of the profession: excellence, collaboration, respect, and compassion. The clinician teachers who work in such communities shape the practices there. Faculty development programs and academies of medical educators seek to create a space where a community of teachers can share their ideas about teaching and learning. This involves building a culture that values continuous learning and the scholarship of teaching and learning, a communal space also known as a "teaching commons" (Huber & Hutchings, 2005; Irby, Cooke, Lowenstein, & Richards, 2004): "As *Scholarship Reconsidered* (Boyer, 1990) made clear, the professional responsibility of educators was to engage continuously in their own efforts to study the quality of their work, its fidelity to their missions, and

its impact on students intellectually, practically, and morally" (Shulman, 2005a, p. vi). Therefore, teachers and learners are powerfully shaped by the values and practices of their professional communities.

Yesterday's Legacy, Tomorrow's Practice

Medical education and the practice of medicine have come a long way in the past hundred years. Although he would easily understand the current paradigm of physician education, Flexner would hardly recognize the contemporary practice of medicine. He would applaud the scientific basis of medicine and the progress that has been made in advancing health. However, he might wonder if the old structures of medical education can continue to support the rising challenges to the curriculum, pedagogies, and assessment of medical education. Accordingly, in the next chapter we examine the practice of medicine and the nature of learning, an essential discussion that must preface any description of how medical education is—and should be—structured.